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News

Stem cells to grow cartilage

Replacement cartilage could be grown for transplantation, following the conversion of human embryonic cells into cartilage cells. The research involved growing human embryonic stem cells with chondrocytes, in Petri dishes in a specialised system to encourage them to change into cartilage cells. These were implanted in mice on a bioactive scaffold for 35 days, removal of the scaffold yielded new cartilage produced upon transplantation.

Dr. Arachana Vats, Consultant ENT Surgeon, Imperial College, UK, told the IJS: ''The current challenge facing medicine is inherently one of its own making - an increasingly ageing population and the obvious sequelae of increasing biological lifespan. Also, both the disease process itself as well as the therapeutic options that we implement result in destruction and malformation of tissues. The main problem is how to generate adequate numbers of cells. Reconstructing an injured face is a prime example of when the limitations of existing techniques of restoration become apparent. Injuries and diseases which affect cartilage account for in excess of US$10 billion healthcare spending per year on artificial joint replacements. With patients living longer, one joint replacement is often not sufficient to last the rest of their natural life. Also, with life expectancy increasing, more patients are needing these treatments. Cartilage is a highly specialised tissue with very poor intrinsic repair capacity. The ability to generate unlimited supply of cartilage for repair and regeneration, could have potential applications everywhere ACI is used now and hopefully in more severe cases of joint damage. Also, anywhere cartilage is required, eg in otorhinolaryngological -head and neck surgery, for reconstructive procedures following head and neck cancer resection; facial plastic reconstructive procedures including cosmetic surgery (eg septorhinoplasty, congenital malformations); septal perforations; tracheal reconstruction etc''.

Intellectual property of the human genome

A survey of patent records has shown that 20% of human genes are already patented by biotechnology companies. The introduction of commercial rights could limit research into areas, such as diabetes and obesity, whilst risk the threat of legal action for ownership of specific genes. In some instances the rights to certain genes, such as BRCA-1, are claimed by multiple companies, with around 20 patents specifying rights of use. Researchers at the Massachusetts Institute of Technology (MIT) calculated the proportion of human genes that had been patented by comparing the genetic sequences claimed in US patents to genes listed in the National Centre for Biotechnology Information gene database. Monopolising genes poses a potential problem for future medical research. Kyle Jensen, researcher at MIT, told the IJS: ''4,382 of the known 23, 688 human genes, have been patented, with over half owned by private companies. Around 63% of the patents are assigned to private firms.'' Dr Murray analyses the patenting of human genes in the US, although it is probable that the same genes may have been patented in Europe.

Jensen and Murray. Science. 2005; 310(5746): 239–40.

Stem cells enable paralysed mice to walk

Scientists at the Reeve-Irvine Research Centre at the University of California, USA, have successfully injected stem cells that heal spinal injuries allowing

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paralysed mice to walk again. Stem cells (75,000) were injected above and below the injury site, in 50% of 68 mice. Experiments showed that the stem cells had formed new neurons and coatings allowing nerves to signal properly again. Professor Anderson told the IJS: ''Immediately after the injury, nerve cells inside die and others lose their ability to pass on signals. Animals that didn't get stem cells could only walk a little, and even though they improved slightly over the first two to three weeks, they were really struggling. This kind of work has another benefit, especially in America where it's a more contentious issue, in that it shows people the potential of using stem cells to treat''.

New imaging technique predicts likelihood of bone breakage

Scientists have developed a laser imaging technique which can fully assess the strength of bones, a technique the scientists hope can be used to predict the likelihood of young women developing osteoporosis. Early action such as increasing exercise to build up bone mass would prevent the need for pharmacological interventions with Risedronate (Actonel). Lead author Dr. Edward Draper of Imperial College told the IJS: ''Traditionally, the only way to predict bone strength has been through X-rays, but these can only measure part of the strength of the bone. Using this new technique we can get a more complete measurement, allowing us to predict better the risk of fractures as a result of osteoporosis. We hope we can further develop this technique, and use it as part of a national screening programme which hopefully could be done in any GPs surgery. By identifying the risk of any problems developing early enough, this could not only make an enormous difference to the health of individuals, but could help the NHS by negating the need for more extreme and costly interventions later.'' X-rays can only be used to measure bone mineral density, which only accounts for part of the strength. The new Raman spectroscopic technique enables measurement of collagen, which also affects bone strength.

Enzyme test for bladder cancer may expedite diagnosis

Measuring levels of the enzyme telomerase in urine may be a simple, inexpensive, and accurate way to detect bladder cancer early, according to Dr D. Calistri. Diagnosis of bladder cancer is often delayed because symptoms such as haematuria are intermittent and can be attributed to common benign disorders, for example, urinary tract infections, prostatitis and renal stones. As a result, patients with symptoms are often not screened for cancer with cystoscopy. Telomerase was chosen as a possible tumour marker because elevated levels have been found in nearly all human histotypes. In a study of more than 200 men, the telomeric repeat amplification protocol (TRAP) achieved a sensitivity of 90%. The sensitivity of the TRAP test was similar for low-grade and high-grade tumours.

Sanchini MA et al. JAMA 2005; 294:2052—2056.

Prostate cancer seed placement

Currently, eradication of diseased prostate tissue involves implanting up to 100 radioactive seeds in the prostate. Each seed is akin to a grain of rice and emits radiation in all directions. A hole-studded grid is mounted over the patient and a hollow needle used to insert the seeds manually. Directionally emitting radioactive sources, have been developed by UW-Madison engineering physics Professor D. Henderson and medical physics associate Professor B. Thomadsen. Their directional seed sources work by vertically shielding along one side. The traditional grid has been abandoned in favour of a robot, which delivers seeds more precisely. Dr. Thomadsen told the IJS: ''Seeds can now be implanted, at the boundaries between healthy and

Dr Draper adjusting lasers at the Rutherford Appleton Laboratories

diseased tissue, which targets the radiation to where it is most needed.''

British therapeutic stem cell bank on the horizon

Scientists have calculated that circa 150 stem cell lines would be needed to establish a therapeutic stem cell bank in Britain. Stem cells have the potential to provide new therapies for diseases ranging from cancer and diabetes to Alzheimer's disease and spinal cord injuries. Britain set up the world's first stem cell bank in May 2004. Professor JA. Bradley, of Addenbroke's Hospital in Cambridge, told the IJS: ''We found that 150 donors would give a very good match for about one in five recipients''. Like donor organs, stem cells from a therapeutic bank need to be matched to the recipient minimizing the risk of rejection and the need for immunosuppressant drugs. Unlike a heart, lung, or liver transplant, which is provided by one donor for one patient, a single stem cell line could be used for multiple recipients. The use of embryonic stem cells is controversial because the master cells that can form into any cell type in the body are derived from spare in-vitro fertilization (IVF) embryos. The British Chancellor Gordon Brown announced that the country would double spending on stem cell research to 100 million pounds over the next 2 years. Part of this funding will be used to support the stem cell bank.

Taylor et al. The Lancet 366 (Issue 9502): 2019—2025.

Anti-heparin antibody identifies increased risk following cardiac surgery

Elliott Bennett-Guerrero, of Duke University Medical Center, USA, reports a positive test for anti-platelet factor 4/heparin antibody before cardiac surgery nearly doubles the risk of complications ($P = 0.0284$). In a series of 466 patients, 108 patients had complications that led to death, or hospitalization of more than 10 days. Fifty-nine patients (13%) had detectable levels of the anti-heparin antibody at baseline. Other significant predictors of outcome were age ($P = 0.051$), ejection fraction ($P = 0.005$), and preoperative haematocrit ($P = 0.0432$). All patients were screened before undergoing elective coronary artery bypass or valvular surgery. Preoperative serum levels of the antibody ranged from 0.02 to 3.11 OD units, with a mean of 0.29. The authors note that a limitation of their study is that anti-heparin antibodies could represent a surrogate marker for sicker patients at greater risk for adverse outcomes. Dr. Bennett-Guerrero told the IJS: ''Further studies should investigate whether alternative combinations of intraoperative and postoperative anticoagulation or anti-platelet therapy are beneficial''.

Bennett-Guerrero et al. Journal of Thoracic and Cardiovascular Surgery 2005; 130: 1567—1572.

Differentiation of heart stem cells discovered

A team of scientists at the Gladstone Institute of Cardiovascular Disease (GICD) has identified a key factor in heart development that could advance gene therapy for treating cardiac disorders. In the study, using *Drosophila* fly embryos as model systems, the research team demonstrated that a form of miRNA known as miR-1, helps in determining heart stem cells in the early embryonic stage. They further showed that miR-1 helps in maintenance of heart precursors in later embryonic stages. In addition, miR-1 can repress the ligand Delta, which otherwise binds to its receptor, Notch. Importantly, the binding of Delta and Notch mediates development of many kinds of tissues and is involved in differentiation of cardiac stem cells into muscle cells. They hope that the findings will be used in future to target gene-mediated therapies preventing early heart developmental problems.

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